MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

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Rev. CHARLES PRITCHARD, M.A., F.R.S., in the Chair.

George Parker Bidder, Esq., Paper Buildings, Temple;
Capt. Drayson, R.A., Military Academy, Woolwich;
R. P. Greg, Esq., Prestwich, Manchester;
R. J. Lecky, Esq., Stock Orchard Villas, Caledonian Road;
John Sorley, Esq., LL.D., Principal of the College, Birkenhead;
Thos. Hunter Maule, Esq., LL.D., Vice-Principal of Birkenhead College; and
The Rev. Wm. Owen Williams, Pwlcheli, Carnarvonshire.

were balloted for and duly elected Fellows of the Society.

Rotation of Mars. By Richard A. Proctor, B.A.

A series of clearly marked views of *Mars*, taken by Mr. Browning in January and February, 1867, afforded me the opportunity of estimating the rotation of *Mars* by means of an interval of nearly 201 years. In doing this I detected some slight errors in my former calculation. First, the construction of a chart of the orbits of the four inner planets enabled me to form a more accurate estimate of the difference in the geocentric longitude of *Mars* on April 24th, 1856, and on November 26th, 1864, as compared with his geocentric longitude on March 13th, 1666; secondly, the preparation of a chart of *Mars* suggested alterations in the corrections for phase; and, lastly, I found that

I had unaccountably dropped a day in taking the interval of 198 years. The effect of the last error is less important than might be supposed at first sight, since on adding twenty-four hours to the interval, we have to add one rotation of *Mars* to the number taking place in the interval, and it is the difference between one rotation of *Mars* and twenty-four hours (*i.e.* about $37\frac{1}{3}$ minutes only) which has to be distributed amongst upwards of 70,000 rotations.

I now present in a table the results of the calculation of three long periods, viz. from March 12th, 1666, $12^h\ 20^m$ (astronomical time and New Style) to

April 24th, 1856 .. .. (i)
Nov. 26th, 1864 .. .. (ii)
Feb. 23rd, 1867 .. .. (iii)

Int.	Interval in secs.	Cor. for Geoc. Long.	Cor. for Phase.	Corrected Int. in seconds.	No. of Rotations.	Resulting Rotation Period.
(i)	5999524200	0°	− 12°	5999521246	67682	88642·737
(ii)	6270650760	− 248	0	6270589696	70740	88642·734
(iii)	6341394300	− 273	+ 3	6341326590	71538	88642·734

Here the results have been brought into close agreement by selecting suitable values for the phase-corrections. That these values are not far from the truth will be seen by the accompanying tracings of the views in question (see Plate); the arc from cross-line to cross-line along the equator of *Mars* being, of course, 30°.

The corrections for geocentric longitude may be depended upon as being within 1° of the truth. In the accompanying copy of my plate of the orbits of *Mars*, the Earth, *Mercury*, and *Venus*, the positions of *Mars* and the Earth at the several epochs are indicated and connected by straight lines. In determining the approximate position of the Earth at any date several circumstances have to be considered. Thus take the opposition of *Mars* in March, 1666. I find that this took place at midnight (nearly) on March 18th. But it will be seen that the opposition line is placed about one quarter of a degree in advance of the position given to the Earth on March 21. The explanation of this will illustrate the process applied to each epoch:—

My chart shows the position of the Earth from day to day on the supposition that at noon on the 21st December the Earth is at the winter solstice. Now, nearly enough for our purpose, this was the case in leap-year in the beginning of the seventeenth century. But the Earth was about 45′ in advance of the winter solstice at noon on December 21st in leap-years *at the end* of the seventeenth century,—therefore, in 1664, about 30′ in advance. Again, in each common year the Earth loses 15′, so that in 1666 there was at any hour of any day, after February 28, a loss of

about 30′ from the position held by the Earth at the same day and hour in 1664. Therefore the position of the Earth at midnight, March 18th, 1666, was about that which would correspond to that date as the chart stands; that is, about two days and a half's motion (or nearly $2\frac{1}{2}^\circ$) behind the point marked March 21st. But owing to the precession of the equinoxes the lines ♋ ♈, and ♎ ♈ in my chart must be shifted about $2\frac{3}{4}^\circ$ forwards around their point of intersection to indicate the position they had in 1666. The difference $\frac{1}{4}^\circ$ indicates the amount by which the opposition-line in question is in advance of the position given to the Earth on March 21st in my chart.

The close agreement between the results obtained,—and that without any noteworthy *forcing* of the correction for phase, *the only doubtful point in the whole question*, induces me to look on the value

$$88642{\cdot}735 \text{ sec. or } 24^h\ 37^m\ 22{\cdot}735^s.$$

as very near the true value of *Mars'* rotation period.

Inductive Proof of the Moon's Insolation.

By J. Park Harrison, M.A.

1. On the assumption that the Moon's substance has a capacity for heat, the mean maximum state of insolation of any hemisphere would evidently be attained at the period of the lunation when the largest surface has been continuously exposed to the Sun *for the longest duration of time.* This occurs at the third or last quarter, when the half-moon then illuminated has been subjected to the solar radiation for a mean period of 265·5 hours $\left(\frac{177 \text{ hrs.} + 354 \text{ hrs.}}{2} = 265{\cdot}5 \text{ hrs.}\right)$, and the remaining half, now in shade, has very recently received the Sun's rays for a period of equal duration.

The epochs of maximum and minimum heat are clearly shown on a horizontal section of the Moon in the diagram (fig. 1), where the light and dark crescents represent her state of insolation in proportion to the number of days during which the Moon's surface has been exposed to or withdrawn from the Sun.*

2. Now the heat which is acquired by the Moon,† and radiated to the Earth, is entirely dark heat; and this, as Prof. Tyndall has pointed out, "would be almost wholly absorbed by our

* The plus signs before the figures in this diagram (+ 1 to + 15) indicate the number of days of sunshine. The minus signs indicate the number of days of shade. In fig. 2 the dark tint A represents heat; the lighter tint B, cold.

† The German physicist Herr Althaus has estimated the heat of the Moon on the 22nd day of the lunation by an elaborate process at several hundred degrees of Fahrenheit. *Pogg. Ann.* 90, p. 551.

atmospheric vapour."* It would consequently tend to raise the temperature of the air above the clouds, and cause increased evaporation from their surface. Cloud would therefore be diminished in density and raised to a higher elevation, and under favourable circumstances it would be dispersed;† in either of which events a sensible fall would necessarily be caused in the temperature of the air near the ground, owing to increased radiation of terrestrial heat to the sky. And precisely opposite results would occur at the period of minimum heat in the Moon.

If our ordinary thermometers, then, give no indication of any changes of temperature at these seasons, it would show either that the Moon is *not* heated by the Sun, or that her state of insolation is insufficient to produce the physical effects which would otherwise have followed.

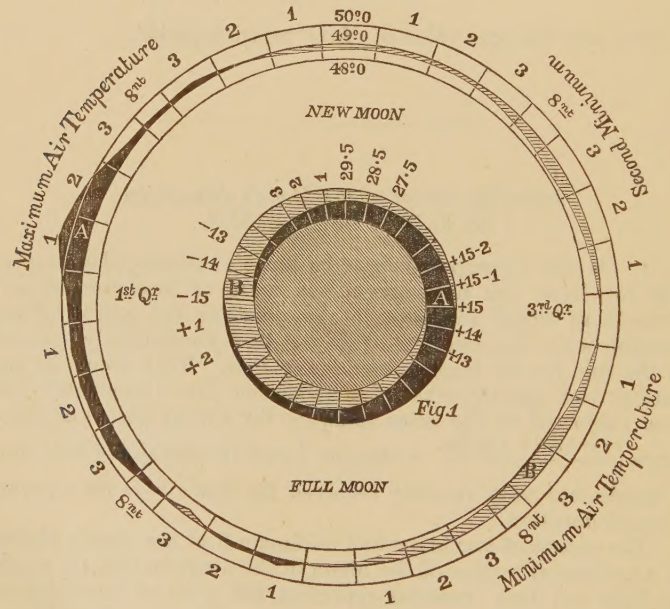


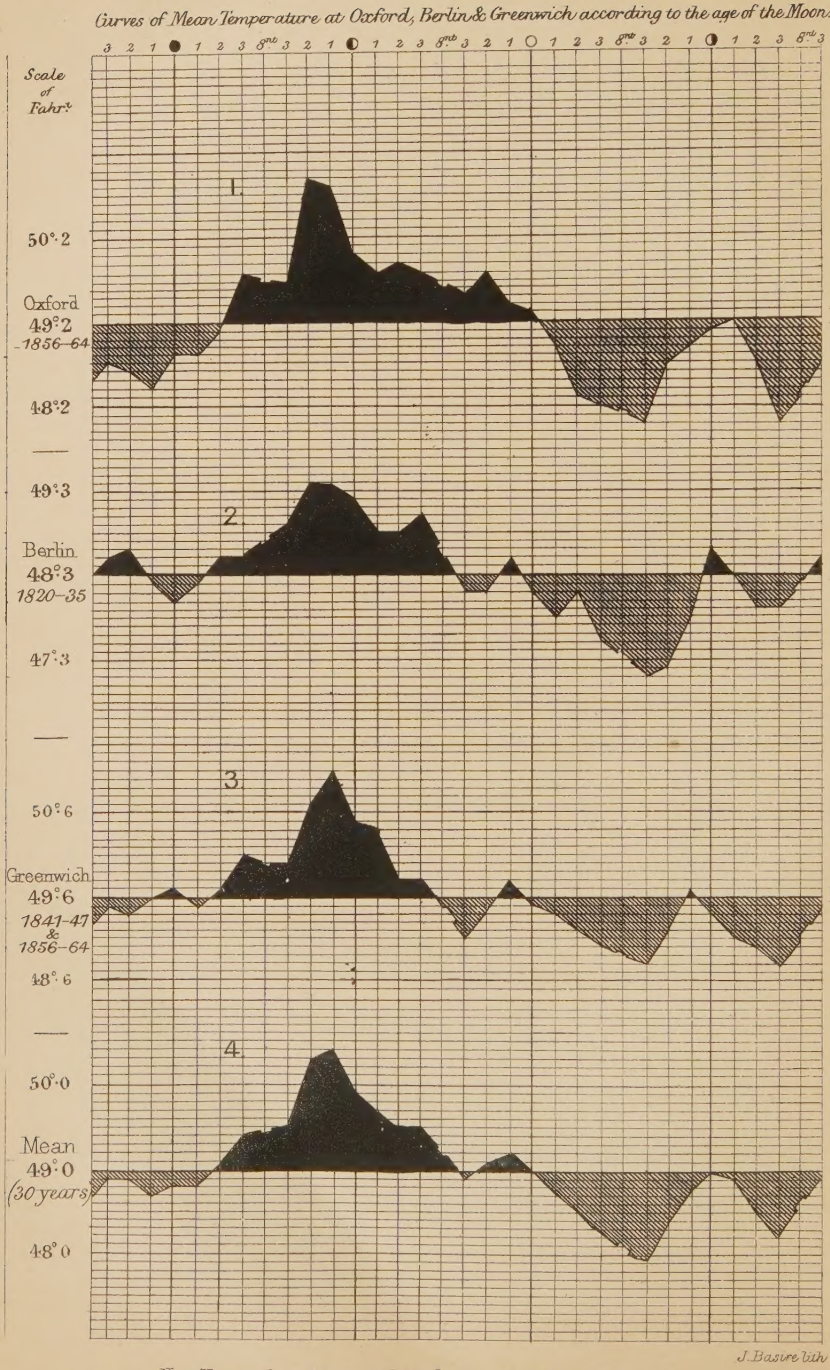
Fig.1

Fig.2

3. The daily mean temperatures, however, at the Observatories of Oxford, Berlin, and Greenwich, when arranged in tables according to the age of the Moon, show conclusively that the temperature of the air near the surface of the ground is very sensibly affected; the maximum mean temperature occurring on

* *Heat*, &c., p. 147. See also Herschel's *Outlines of Astronomy*, 432, p. 261.

† Herschel's *Lectures on Scientific Subjects*, 1866, p. 149.



Note, The number of Octant days [∽] is about half of the others

the average, at each of the three stations, upon the 6th and 7th day of the lunation, when the Moon's crust turned towards the Earth is coldest; and the minimum mean temperature some time after full Moon, when the same crust has been exposed for several days to intense radiation from the Sun.*

This will be seen in the diagram (fig. 2), where a curve of the mean temperatures for each day of the lunation, described about the section of the Moon already referred to, shows the contemporaneous conditions of air-temperature and lunar insolation. The curve itself is derived from the mean results at the three Observatories.

In the curves formed from these means, the dark tint indicates a mean temperature above the average, whilst the lighter tint indicates a mean temperature below the average. It will not escape notice that they coincide in a very remarkable manner (see Plate of Curves).

The Berlin mean temperatures, which were tabulated by Dr. Mädler thirty years ago, were derived from observations taken at 5 A.M and 2 P.M. from 1820 to 1835. The difference between the maximum at first quarter and the minimum near the last quarter is 2°·3 Fahr.†

At Oxford the daily means were obtained from twelve readings of traces of the self-registering Thermograph, with a few interpolations. The difference between the maximum and minimum mean temperatures is 2°·8 Fahr.

The Greenwich means were derived from the 2-hourly observations of 1841–47; excepting the means on Sundays and holidays, which are simply arithmetical means of the self-registering maximum and minimum thermometer. From 1856 to 1864 inclusive they were derived from the ordinary daily observations corrected by a small quantity and checked by an examination of the photographic curves. The difference between the maximum and minimum results is 2°·3 Fahr.

The mean difference in the value of the results at the three Observatories is 2°·5 Fahr.

4. It will be noticed in the diagram (fig. 2) and also in each curve (see Plate), that, whilst there is but one period of maximum air temperature, two minima occur at nearly equal distances on either side of the Moon's third quarter. They are separated by a marked rise in the curve at the time the greatest heat is assumed to be attained by the Moon, and consequently the lowest mean temperature of the air might have been looked for.

This apparent exception to the physical law above indicated seems to afford additional proof that the general results are due to

* For method of tabulation see *Proceedings of the Royal Society*, May 1865, p. 224.

† On ascertaining the occurrence of the maximum air-temperature on the 6th day after new Moon, Dr. Mädler seems to have put the figures aside for confirmation. He has not since then, that I am aware of, made any use of them; or suggested any explanation of the results.—See *Der Mond*, p. 164.

the causes to which they have been assigned—*fresh cloud having been found to arise a day or two before the third quarter** to supply, as it would seem, the increased demand† for vapour at that period. And the moment when this periodic cloud is dispersed or raised by the agency of the Moon's heat is signalized by the rapid fall in temperature which occurs immediately afterwards. Possibly, however, some part of the lunar radiant heat may reach the surface of the Earth at the time of the Moon's maximum insolation, and so assist in raising the temperature of the air, and in producing increased evaporation.‡

No rise or fall in air-temperature of any amount occurs at new or full moon, though a tendency towards change seems clearly indicated shortly before full moon.§

The maximum effects, then, synchronising so nearly with the epochs of maximum and minimum exposure of the Moon's surface to solar radiation, seem to prove that our satellite is heated by the Sun.

5. The relation which has been thus traced between the Moon's heat and the daily variations of mean temperature, whilst it confirms the world-wide belief in lunar influence, reduces it to its real importance and frees it from the haze which has so long surrounded it. The effects produced would necessarily vary with the amount of cloud and vapour which from time to time happens to be present in the air; and this does not primarily depend upon the Moon.

Ewhurst, Dec. 24, 1867.

A Determination of the Moon's Mass. By E. J. Stone, Esq.

In a Note "On the Value of the Solar Parallax as deduced from the Parallactic inequality in the Earth's motion," printed in the last number of the *Monthly Notices*, I have deduced the value of the Moon's mass from the equations as given by Serret without the modifications introduced by Professor Newcomb. I have since determined these equations independently, retaining all terms of the third order in the Lunar Theory. My results do

* I found this to be the case on tabulating the mean amount of cloud and contemporaneous air-temperature at Greenwich in 1841-47. Both cloud and temperature were found to rise above the average on the three days preceding third quarter. And this was not caused, as I ascertained, by any change in the direction of the wind.

† See Hopkins' *Atmospheric Changes*, p. 333.

‡ See *Annuaire du Bureau des Longitudes*, where Schübler and others are quoted as having found the minimum of cloud to occur after third quarter. *Ann.* 1833, p. 61.

§ Herschel's *Lectures on Scientific Subjects*, p. 149.

not agree with those obtained by Professor Newcomb. As the deduction of the Moon's mass from the theories of Precession and Nutation is a point of real importance, I print my results.

I take γ to denote Delaunay's constant, which, in the first approximation, is equal to the sine $\frac{1}{2}$ (inclination of lunar orbit); a, a_1 the *mean* distances of the Moon and Sun; e, e_1 the excentricities of the lunar and solar orbits; $\varkappa$ a constant depending on the Sun's mean disturbing force, the moments of inertia of the Earth, and the Earth's angular velocity; μ, the motion of the Moon's node, relatively to the line of equinoxes, in a Julian year;

$$\varepsilon = \frac{\text{Moon's Mass}}{\text{Sun's Mass}} \frac{a_1^3}{a^3};$$

I then find

$$\text{Luni-Solar Precession} = \varkappa \left[1 + \frac{3\,e_1^2}{2}\right] + \varkappa\,\varepsilon \left[1 + \frac{3\,e^2}{2} - 6\,\gamma^2\right],$$

$$\text{Constant of Nutation} = \varkappa\,\varepsilon \frac{2\,\gamma}{\mu}\left(1 + \frac{3\,e^2}{2} - \frac{5\,\gamma^2}{2}\right).$$

From which formula I find, with Luni-Solar Precession $= 50''{\cdot}378$ and Nutation $= 9''{\cdot}223$.

$$\frac{\text{Moon's Mass}}{\text{Earth's Mass}} = \frac{1}{81{\cdot}36}.$$

It appears to me that Serret's formulæ are not accurate to the third order. His c would no longer be a constant.

Jupiter and his Satellites. By Thomas Barneby, Esq.

Having had a clear view of the phenomenon on the 21st August last, soon after its commencement, and during the progress which I witnessed, I trust my observation may be recorded.

I used the whole aperture of my 9-inch Equatoreal, made by Mr. Cooke for the late Captain Jacob.

When I first saw the planet, the shadow of the *third* satellite only was on its disk. The *third* satellite itself next made its ingress, and I afterwards saw the several ingresses of the shadows of the *fourth* and *first* satellites, and of such satellites.

The *second* satellite had then become eclipsed, leaving no satellite visible, except on the face of the planet.

The three shadows were perfectly black, and there was no perceptible penumbra, although the outlines were not so clearly defined as I have seen them with a smaller instrument.

The three satellites, when on the disk, were of different colours, the *first* was the lightest and brightest, resembling most its colour when off the disk, and the *fourth* was as black as its shadow.

The *third* satellite was generally of a cinnamon colour, but on its south-western side there was a large double spot of a much darker cinnamon or sponge colour. These markings were very peculiar, and are well delineated in Mr. Dawes's paper in the *Monthly Notices* of November last. I have before described them, as on the apparent east side, which accords with the south-western side, allowing for inversion and the position of the planet.

The belts in the neighbourhood of the equatorial regions of the planet were illuminated with a brilliant rose-coloured tint, which added much to the beauty of the view, and reminded me forcibly of a terrestrial "Evening-red" of more than ordinary magnificence.

South Villa Observatory, Worcester,
16th December, 1867.

Results of the Observations on Sun-spots made in Kew and in Dessau during the Year 1867. Communicated by Messrs. De La Rue, Stewart, and Loewy.

	Kew.				Dessau.			
Months.	No. of new Groups.	Numbers.	Days of Obs.	Days without Spots.	No. of new Groups.	Numbers.	Days of Obs.	Days without Spots.
January	0	..	6	6	0	..	23	23
February	0	..	10	10	0	..	26	26
March	3	770 to 772	10	6	3	1 to 3	26	15
April	2	773 to 774	15	9	1	4	24	16
May	1	775	13	9	2	5 to 6	26	16
June	0	..	13	11	1	7	30	23
July	2	776 to 777	19	14	2	8 to 9	31	18
August	0	..	0	..	3	10 to 12	31	20
September	1	778	8	0	1	13	30	17
October	3	779 to 781	11	3	3	14 to 16	28	13
November	2	782 to 783	10	3	4	17 to 20	22	5
December	3	784 to 786	5	1 (?)	5	21 to 25	15	3
Total	17	770 to 786	120	72	25	1 to 25	312	195

Remarks.—The numbers in the Kew list form a continuation of the Catalogue of Groups, published in the first series of "Re-

searches in Solar Physics," by Warren De La Rue, Balfour Stewart, and Benjamin Loewy, pp. 6–8.

Those days on which it is doubtful whether spots were on the Sun or not, have the sign (?) after them.

Necessary repairs and alterations in the Kew dome caused an interruption in the regular work of the Photoheliograph from August 9th to September 9th.

Although the number of groups observed is the lowest since the commencement of regular Sun observations in 1825, still there were among the number several of very considerable size (March 31, April 5 and 6, and September 9–21). Large solitary spots made their appearance towards the end of the year.

Hofrath Schwabe reports that the uniform brightness of the Sun's surface observable, is the beginning of the year, and the almost total absence of faculæ, both of which phenomena were some time ago submitted to the attention of the Fellows of the Royal Astronomical Society, have disappeared, and that since October the luminosity has again diminished near the edge.

On November 12th, 2^h P.M. (Dessau M.T.), during a very short glimpse of sunlight, he observed near the limb two or three luminous bodies of a cloudlike, fleecy appearance, quite similar to those which he has observed in former years; unfortunately he had no time to study them more closely.

Note on the Variable Star, T *Serpentis.*

1860, $\alpha = 18^h\ 21^m\ 59^s$; $\delta = +6^\circ\ 12'7$. By J. Baxendell, Esq.

This Variable was discovered at Mr. Worthington's Observatory, Crumpsall, in July, 1860, as an outlier of the fine Cluster, No. 72 of Sir William Herschel's 8th class, and a brief account of it was inserted in the *Monthly Notices* for January, 1861; but as it appears not to have been seen since by other observers, and may therefore be supposed to have been merely a temporary star, I have thought it desirable to communicate to the Society the results of all the observations I have hitherto made.

Observed maxima of T *Serpentis*:—

1861	May 12	10·5 mag.
1862	April 17	10·7
1863	April 1	11·0
1866	Dec. 10	11·0
1867	Nov. 25	10·3

Equating, and treating by the method of least squares, we have

Epoch = 1864, Feb. 29.
Mean period = 340·5 days.

Calculating the times of maximum from these elements, we have the following differences between the calculated and the observed times:—

C − O in days
+ 1·5
+ 2·0
− 6·5
+ 6·5
− 3·0

The greatest difference being only *one fifty-second* of the mean period, it appears that T *Serpentis* belongs to the list of moderately regular periodical variables. When at minimum it is below the 14th magnitude. Its next maximum is due 1868, October 27·5, at which time it will be favourably situated for observation.

Cheetham Hill, Manchester.
January 8, 1868.

On the Maximum of U *Geminorum.* By G. Knott, Esq.

I beg to offer to the Society the following observations of the maximum of Mr. Hind's curious variable star U *Geminorum*, which occurred in December last. The observations were made with my 7½-inch Alvan Clark refractor, the magnitude of the variable on each occasion being deduced from a careful comparison with a selected list of neighbouring stars. The light-ratio of the magnitude scale employed is 2·512.

Observations of U *Geminorum.*

Date.	h m	Mag.	Remarks.
Dec. 3 1867,	9 20 G.M.T.	under 13	Not seen.
7	10 25	9·4	U bluish white, disk ill-defined.
12	11 10	9·6	Moonlight, and clouds troublesome.
18	8 0	11·05	U rather large for its mag., shining with a dull bluish white light.
22	8 45	13·7	Rather brighter at intervals?
27	11 10	14·0	
31	10 55	14 ±	Feebly glimpsed. Sky rather hazy.

The observations are not sufficiently numerous to enable me to determine the date of maximum with great nicety, it would

appear, however, to have occurred on December 8th, about nine days later than the calculated date of maximum deduced from the elements given by Dr. Schönfeld in his "Catalogue of Variable Stars."

The rapidity with which this remarkable star goes through its changes, the irregularity of its period, its hazy appearance and peculiar hue, and the curious fluctuations of brightness in short intervals of time which have been sometimes observed, point it out as an object well worthy of careful attention on the part of astronomers.

It is much to be wished that observations of its spectrum could be obtained, as the peculiarity of its appearance suggests the probability that its spectrum would be found to be characterised by the presence of *bright lines*.

Woodcroft Observatory, Cuckfield,
January 9, 1868.

Companion to γ Equulei. By G. Knott, Esq.

On the 9th of July, 1867, I discovered a minute and pretty close companion to *γ Equulei*, which, so far as I am aware, had not been previously observed. Measures with a parallel wire micrometer on the same evening, and on that of July 27th, gave the following mean results:—

P = 276°·84, obs. 11, w. 53; D = 2″·131, obs. 8, w. 24; Epoch 1867·54.

The small star is about the 11th magnitude (corresponding with about the 10th mag. of Struve's Scale), and its colour, a fine clear blue, contrasts finely with the pale yellow of the primary.

Woodcroft Observatory, Cuckfield,
January 9, 1868.

Ephemeris for the Opposition of Iris, 1868, *computed from his Tables of Iris.* By F. Brunnow, Esq., Astronomer Royal for Ireland.

Berlin M.T.	App. R.A.	App. Decl.	Log. Dist. from Earth.
	h m s	° ′ ″	
1868, March 27·5	13 30 11·15	−17 2 22·7	0·28340
28·5	29 19·43	16 57 40·6	0·28252
29·5	28 27·03	16 52 49·6	0·28170
30·5	27 34·00	16 57 50·0	0·28094
31·5	26 40·39	−16 42 41·9	0·28025

Berlin M.T.	App. R.A. h m s	App. Decl. ° ′ ″	Log. Dist. from Earth.
April 1·5	13 25 46·27	−16 37 25·8	0·27962
2·5	24 51·69	16 32 1·9	0·27905
3·5	23 56·71	16 26 30·6	0·27855
4·5	23 1·39	16 20 52·2	0·27811
5·5	22 5·79	16 15 6·9	0·27773
6·5	21 9·97	16 9 15·0	0·27742
7·5	20 13·98	16 3 16·8	0·27718
8·5	19 17·87	15 57 12·7	0·27700
9·5	18 21·71	15 51 2·8	0·27689
10·5	17 25·55	15 44 47·7	0·27684
11·5	16 29·44	15 38 27·7	0·27686
12·5	15 33·46	15 32 3·1	0·27695
13·5	14 37·65	15 25 34·3	0·27711
14·5	13 42·09	15 19 1·8	0·27733
15·5	12 46·81	15 12 26·0	0·27762
16·5	11 51·89	15 5 47·4	0·27797
17·5	10 57·37	14 59 6·2	0·27839
18·5	10 3·31	14 52 22·9	0·27888
19·5	9 9·77	14 45 37·7	0·27943
20·5	8 16·81	14 38 51·2	0·28005
21·5	7 24·50	14 32 3·7	0·28073
22·5	6 32·87	14 25 15·8	0·28148
23·5	5 41·99	14 18 27·9	0·28228
24·5	4 51·89	14 11 40·5	0·28315
25·5	4 2·63	14 4 53·9	0·28408
26·5	3 14·26	13 58 8·6	0·28507
27·5	2 26·81	13 51 25·1	0·28612
28·5	13 1 40·33	−13 44 43·9	0·28723

Opposition, April 12, $12^h\ 3^m\ 34^s\cdot8$ Berlin M. Time.

The Lunar Crater Linné. By Capt. W. Noble.

Since the appearance of Mr. Birt's letter in the 27th volume of the *Monthly Notices*, p. 93, "On the Obscuration of the Crater *Linné*," I have (in common, I suppose, with every possessor of a telescope) from time to time examined *Linnæus*, with a view to detecting any change which might conceivably be in progress in it. Up to a very recent period, indeed, all such examinations have had an entirely negative result. In the place where Beer and Mädler depict an annular crater I have hitherto seen nothing but a small ill-defined white patch or spot, with soft edges; presenting,

even under the most favourable illumination, the aspect of any other small crater, near the centre of the lunar disk, at the time of full Moon, though without the sharpness of outline which would characterize it.

Subsequently to reading the paper by my friend Mr. Huggins, too, at p. 296 of the last volume of the *Notices*, I made an attempt to get a glimpse of the minute crater which he there depicts, but, as before, without effect. Ultimately I made up my mind that my optical means were insufficient for the scrutiny, and gave myself very little more trouble about it.

It was with no small surprise then, that, on looking at the *Mare Serenitatis*, at 5^h on the evening of Sunday, the 3rd November, I was struck by seeing *Linnæus* as an unmistakeable shallow crater, of somewhat elliptical form, and with the S. W. part of its surrounding wall rather thicker than the remaining portion. The floor of the crater was identical in tint with the surrounding *Mare*, and the effect presented at once suggested the aspect of the well-known nebula 57 *Messier*, between β and γ *Lyræ*. I was employing a power of 154 on my 4·2-inch achromatic of 61 inches focal length, when I first caught sight of *Linné*, but exchanged this for one of 255 for confirmation of detail. It is with the last-named power that the accompanying sketch* was made. I did not attempt any micrometrical measurements, but contented myself by drawing, with my eye at the telescope, what I saw at moments of the best vision. The extreme shallowness of *Linnæus* was curiously shown by the contrast presented by the remarkable blackness of the shadows of the minute craters to the north of it.

The Lunar Crater Linné. By J. Joynson, Esq.

On the 1st January, 1868, at 8^h P.M., it was not easy to make out where *Linné* exactly was in the field of the telescope, and when found it was far from being bright, and looked ill-defined and flattish. It appeared as though it was situated in a sort of trough formed by two "veins" or "ridges," that trended past it about due South, which "veins" were judged to be higher than *Linné* itself, particularly that on the western side.

On the 3d January the above-mentioned "veins" could not be found, but *Linné* itself was distinctly seen as a small black crater very well defined, surrounded by the usual hazy brightness. The following and south following part of the crest of the crater was the brightest, but the whole crest looked bright by contrast with the deep blackness of the centre. The crater lays rather south preceding the middle of the hazy brightness; but when it

* The sketch referred to closely resembles that given by Mr. Huggins, vol. xxvii. p. 296.— *Ed.*

was best seen, it looked as if the brightness was not so extensive as it usually appears, and the crater itself was very near the centre of it.

The crater was found with a positive eye-piece of a power of about 400; and though it was afterwards seen with the ordinary eye-pieces, both negative and positive, yet it was with considerable difficulty, and would certainly not have been made out with them. I think it was best seen when the rest of the Moon's surface was a very little out of focus.

As the Moon got up to and past the meridian, it became more difficult to make out the crater; and at $7^h\,40^m$ P.M. it required considerable attention to make it out at all, even with the beforementioned eye-piece. At $7^h\,15^m$ there appeared to be just above the crater a bright "spur" projecting out of the hazy brightness." The shallow crater could not be seen.

From what I have observed to-night, I am confirmed in the belief that there has been no change at all in *Linné* itself. The difference has been in observers, their instruments, and time of observation. I am convinced that I never should have seen the crater if I had not had this eye-piece, which, however, does not belong to the telescope. I use it with the microscope, and it was quite by chance that I have lately adapted it to and used it with the telescope. With the other eye-pieces *Linné* appears exactly as it did when I first observed it a year ago.

The measures of the whole brightness gave $4''{\cdot}42$, and those for the small black crater gave $1''{\cdot}223$; but I had to measure with the ordinary eye-pieces in the micrometer, which did not show it so well as might have been wished.

Waterloo, January 3, 1868.

On a Contrivance for reducing the angular Velocity of Meteors, so as to facilitate the observation of their Spectra. By John Browning, F.R.A.S.

When detailing to the Society some experiments I made, attempting to determine the characteristics of the spectra of the meteors of 1866, I stated that the great obstacle to any accurate observation arose from the enormous velocity with which the meteors travelled. This obstacle I have tried various means to overcome.

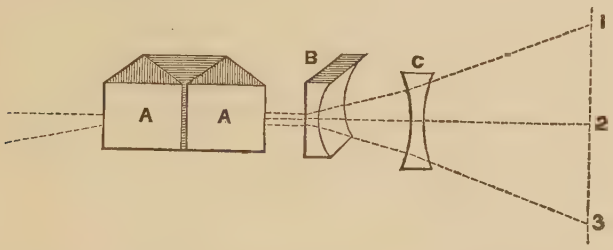
The contrivance I have found most promising consists of a direct-vision prism, having in front of it a deep concave cylindrical lens, and in front of that a double convex lens of the ordinary kind. Both these lenses should be either achromatic, or else made of optical crown glass of the lowest dispersive power.

The action of this piece of apparatus will become apparent upon referring to the accompanying diagram.

In this diagram A A represents a compound direct-vision prism; B, a plano-concave cylindrical lens; C, a double-concave lens with spherical curves of a much less curvature.

The dotted line represents the path of a meteor; the figures 1, 2, 3, three points in its path, and the lines proceeding from these three points, the manner in which the rays proceeding from the meteor are acted upon by the lenses and converged, so as to produce a comparatively stationary image in the prism.

The lens C, is useful in two ways. It assists in the converging action required, thus increasing the field, and it greatly improves the definition of lines in spectra, by bringing rays at right angles nearer to the same focus.



With the apparatus I have just described I have found it easy to obtain the spectra of balls shot from a Roman candle placed only a few yards off from the instrument. The angular velocity of the projected balls under these conditions is, of course, very great, yet the characteristic lines of baryta, strontia, &c., can be readily distinguished in their spectra.

I have the pleasure of exhibiting the apparatus adapted to a spectroscope similar to those I have made for the Royal Society under Mr. Huggins' instructions.

Our opportunities of observing meteors being very few, I have made this adaptation, so that the same apparatus may be used for various purposes.

The Meteor Epoch of November 13–14, 1867.

By V. Fasel, Esq.

The early part of the night of November 13–14 was not very favourable, the sky being rather overcast. Soon after 8^h P.M. it nevertheless cleared up so much as to induce me to make due preparations for keeping watch for the expected shower of meteors. After obtaining the true time from a transit of *Polaris* and other stars, I took my post outside the Observatory. What follows were the results of my watch:—

Nov. 13, at $11^h\ 40^m$ P.M. Wind E. b. N; high thin cirri in

W.S.W. current passed over the Moon, and when 10° East of it, they remained stationary for several minutes, and then gradually vanished.

11h 41m P.M. (G.M.T.). A meteor of the second magnitude shot from above the Pointers in *Ursa Major*, and travelled about 12° due South, towards *Castor* and *Pollux*. Its colour was red: it left a train of red light.

Nov. 14, 0h 11m A.M. Some light whitish clouds appeared in S.E. They came *rapidly* towards the Moon in a N.W. direction.

0h 13m A.M. A lunar corona, lightly coloured.

0h 15m A.M. Sky partially overcast with rapid flying thin scud in S.S.E. current.

0h 30m A.M. Sky overcast. At 0h 40m 28s A.M., saw through the clouds a stationary meteor, which was visible between two or three seconds. Its position must have been in the constellation *Leo*. Its colour was red, and of the size of a tennis-ball.

From 0h 40m 28s to 3h A.M. the sky was quite overcast, but the Moon remained visible through the light clouds that continued to fly rapidly in S.E. current.

From 3h A.M. to 4h 30m the Moon was invisible.

4h 45m A.M. Sky clearing up; a few stars visible.

5h A.M. Fog coming on.

6h A.M. Dense fog. Observations discontinued.

Clapham Observatory, November 14, 1867.

Meteoric Shower, November 1867, *observed at the Cape of Good Hope.* By G. W. H. Maclear, Esq.

I forward the results of the watches for the November Meteoric Shower, kept up at this Observatory on the nights of the 12th, 13th, 14th, and 15th.

Nov. 12th. Commenced watch at 8h P.M., Cape Mean Time, terminating at daylight; only three meteors were observed, viz.—

h m					
11 4	from	Taurus	to	Horizon	Large, blue and white.
11 45	,,	Procyon	,,	Northward	,, red.
11 55	,,	Zenith	,,	Westward	Very large.

Bright moonlight, and violent S.E. wind throughout.

Nov. 13th. Commenced watch 10h 45m, terminating at daylight; nine meteors observed, viz.—

h m s					
11 49 5	from	α Ceti	to	α Andromedæ	Small.
1 50	,,	α Columbæ	,,	S. Pole	Larger, purple and white.
14 48	,,	Regulus	,,	S. Cross	Very fine, green train.

h	m					
14	51	from	Procyon	to	Gemini	Small.
15	35	,,	betw. Regulus and α Hydræ	to	β Corvi	Small.
15	41	,,	Regulus	to	Arcturus	Small, curved.
15	46	,,	,,	,,	Spica	Small.
15	49	,,	,,	,,	Gemini	,,
15	49	,,	,,	,,	,,	,,

Bright moonlight; very hazy low E.; violent S.E. wind throughout.

Nov. 14th. Seventeen meteors observed, principally from *Leo*.

h	m	s					
13	52	0	from	η Leonis	to	Regulus	Orange and green; small.
14	3	0	,,	below Procyon	to	Spica	,, ,, ,, ,,
14	9	0	,,	Procyon	to	Southward	White; long train.
14	18	0	,,	γ Leonis	,,	Spica	Bright; short period.
14	18	22	,,	η Leonis	,,	Gemini	Faint.
14	37	17	,,	Leo	,,	β Corvi	Bright.
14	51	52	,,	γ Leonis	,,	Spica	Small.
14	58	52	,,	,,	,,	,,	,,
15	7		,,	Leo	,,	Procyon	Very small.
15	13		,,	ε Leonis	,,	N.E.	,,
15	14	22	,,	Leo	,,	β Corvi	Green; short period.
15	17	17	,,	about 8° below Regulus	to	Spica	Large.
15	19	57	,,	Leo, below β Corvi,	to	Southward	,,
15	27	37	,,	ζ Leonis	,,	N.E. horizon	,,
15	30	7	,,	Leo	,,	Spica	Small.
15	33	52	,,	below Gemini	,,	Capella	,,
15	34	32	,,	above Regulus	to	Procyon	,,

Fine moonlight night; wind abated; sky clear.

Nov. 15th. Five meteors observed, viz.—

h	m	s					
12	36	44	from	α Hydræ	towards	Spica	Small.
12	39	49	,,	Procyon	,,	Leo	,,
13	27	39	,,	Gemini	,,	N. horizo	,,
13	45	44	,,	α Orionis	,,	,	,,
14	25	44	,,	Aldebaran	,,	,,	,,

Fine calm night; bright moonlight.

The station, as before, was on the roof of the Observatory, with an uninterrupted view of the horizon.

Royal Observatory, Cape of Good Hope,
November 19, 1867.

Meteoric Shower, November 1867, A.M., *off Martinique, West Indies.* Lat. 10°44′, Long. 61° 11′ W.; Time $5^h\ 20^m$ to $6^h\ 15^m$ A.M. Local Time. Communicated by Commander W. Chimmo, commanding H.M.S. Gannet.

Rounding the north point of Martinique at 5 in the morning of the 14th November, while sitting on the bridge, I saw an immense number of bright sparks falling into the sea, at apparently a short distance from the ship, which I thought came from the ship's funnel, as they resembled those of sparks caused by the burning of wood.

I took no further notice until my attention was arrested by a brilliant meteor bursting in the East and emitting sparks like those of a rocket, shooting in a North direction at an altitude of about 37 degrees, and at an angle of 75 with the horizon.

I then called the attention of the First Lieutenant and Master, who were on the bridge at the time, to the meteoric shower then in view, falling rapidly and perpendicularly; every now and then a brilliant meteor bursting and lighting up the whole heavens. It was in reality a grand sight of fireworks.

The spot of blue sky from which they fell was about one-sixteenth of the whole heavens, and from the edge of a dark cloud of nimbus which was hanging over the island.

I merely send this as a simple notice for record, that the shower was seen at this place; but on board a ship, in the anxiety and excitement of going into a strange harbour, was not the time nor place to make any detailed observations.

This shower was much more distinctly seen at Trinidad on the same morning, from 2 A.M. to daylight, when 1600 were counted, and about eight per cent thought to have been missed. The meteors seen were numerous in the N.E., describing arcs of 60°. Some were of a reddish hue; others green, and one of a bright fiery purple, lasting many seconds. From midnight till $5^h\ 30^m$ A.M. 693 meteors were counted; 23 per cent were of the brightest description.

Trinidad, November 26, 1867.

Meteoric Shower, November 1867, *observed at Nassau, Bahamas.* By Captain Stuart.

(*Communicated by Samuel Lawson, Esq.*)

I forward for the information of the Society a table showing the character of the meteoric shower, as observed here on the morning of the 14th inst. The observer, an intelligent and experienced nautical man, was not advantageously placed for an extensive view of the heavens; and two other observers in a better position counted 1100 meteors between $2^h\ 30^m$ and $4^h\ 45^m$ A.M., up to which time Captain Stuart had counted only 800.

They observed them all round the heavens, from N.W. to S. and some overhead. From 4 A.M. the meteors appeared to radiate principally from a centre a little to the S.E. of the zenith, and shot in all directions. The position of Nassau is 25° 5′ N. lat. and 77° 22′ W. long. S. L.

Government House, Nassau,
22nd November, 1867.

Observations with regard to the Meteoric Shower taken at Nassau, N.P., Bahamas (Lat. 25° 5′ N., Long. 77° 22′ W.), on the morning of the 14th Nov. 1867, by Captain Stuart, Deputy Inspector of Lighthouses.

	Proportion of sky clear.	Length of each period. h m	Number of Meteors seen: In each period.	Number of Meteors seen: Total from Commencement
13th Nov. 11 0 P.M.	·3	...	...	...
14th Nov. 1 0 A.M.	...	...	...	...
At 1 32	...	...	1 *a*	1
,, 1 45	...	13	1 *b*	2
,, 1 50	...	5	1 *c*	3
,, 1 57	...	5	1	4
,, 2 0	·5	7	1	5
Before 3 0	...	3	17	22
,, 3 15	...	1 0	23	45
,, 3 30	...	15	52	97
,, 3 40	...	15	32	129
,, 3 50	·6	10	34	163
,, 4 0	...	10	49	212
,, 4 10	...	10	118	330
,, 4 15	...	10	125	455
,, 4 20	...	5	102	557
,, 4 25	...	5	73	630
,, 4 30	...	5	69	699
,, 4 35	...	5	66	765
,, 4 40	...	5	21	786
,, 4 50	...	10	52	838
,, 5 0	·8	10	64	902
,, 5 10	...	10	65	967
,, 5 20	...	10	22	989
,, 5 30	...	10	46	1035
,, 5 34	...	4	5	1040

REMARKS.

a. About 20° E. by N. from *Sirius*, whose altitude was 43° E. of meridian. Direction from N. to S.

b. 10° E. by N. from Polar Star. Altitude 25°, N. to S.

c. In the Great Bear, E. to W.

The proportion of sky visible to the observer, who was only a few feet above the level of the sea, was about ·6.

The Moon shone very bright between $3^h 45^m$ A.M. to daylight. She was about 30° W. of that part of the heavens, where the meteors were chiefly seen.

The direction of the meteors was N. to S. and E. to W., chiefly in that part of the heavens where the Constellation of the *Polar Bear* was, at the altitude of 45°.

No atmospheric or magnetic disturbance was caused by the Meteors while falling.

ERRATUM.

The Erratum, p. 16, should be as follows :—

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In p. 25, columns 5 and 6 of the Table, Comparison with Struve's Stars (Place by Chart for 1826), of Star Struve 409, W. H. IV. 44,

For $3^h\ 31^m{\cdot}3$ $70°\ 48'$, *read* $3^h\ 21^m +$ $79°\ 15' \pm$.

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